TRACK 5: RSAF INDIGENOUS PROJECTS

"COMPUTATIONAL FLUID DYNAMICS (CFD) SIMULATION OF HELICOPTER WITH UNDERSLUNG LOAD"

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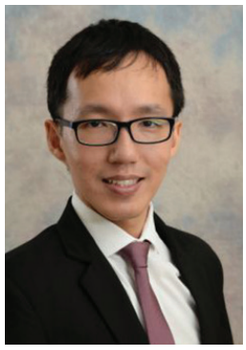
ABSTRACT

This study serves to investigate the unsteady motion exhibited by an underslung load carried beneath Boeing's CH-47D Heavy-Lift Helicopter during static hover. Unsteady motion such as yawing of the underslung load was observed in flight, which could pose potential safety risks during underslung operations. This study focuses on utilizing Computational Fluid Dynamics (CFD) simulations to conduct preliminary investigations to determine the aerodynamic interactions between the downwash of the helicopter's main rotors with the underslung load. Extensive research on various CFD methodologies to simulate the rotational movement of the rotor blades such as the Moving Reference Frame (MRF) and Sliding Mesh methods were conducted. Subsequently, the aerodynamic loading on the underslung load obtained was used to run a Fluid-Structure Interaction (FSI) simulation to determine the forces and torques acting on the underslung load. Analysis of the results from the simulations showing the forces and torques in the three axes of the system support the observed lateral yawing and vertical translation of the underslung load during steady hover. These key findings were further substantiated by graphical illustrations of the velocity flow fields which reinforces the notion that the unsteady behavior of the underslung load is heavily influenced by the effects of the downwash from main rotor blades of the helicopter. Future work is in progress to extend the study to a helicopter in static hover with the presence of crosswinds and improve the accuracy of the simulations by leveraging on 2-way FSI methodologies.

BIOGRAPHY OF SPEAKER



Ng Bing Feng is Assistant Professor with the School of Mechanical and Aerospace Engineering in Nanyang Technological University. He received his PhD from Imperial College London under the sponsorship of the Singapore National Research Foundation Energy Innovation Programme Office (NRF EIPO). Over the years, he has developed his own numerical model for unsteady aerodynamics, structural vibration, aeroelasticity and load analysis on flexible turbine blades, for which the results were presented at leading conferences and published in top-notch journals in the field of wind/marine energy. His current research interest is in aeroelasticity, helicopter dynamics, building and environment engineering and energy systems.

ME4A Ashley Anil Saran is currently pursuing a B.Eng Aerospace Engineering from Nanyang Technological University, Singapore under the SAF Academic Scholarship. As an Air Force Engineer with a strong interest in CFD simulations, Ashley undertook the opportunity to continue the project and extend the investigation to include the effects of crosswinds as well as conduct experiments to validate the results for the static hover case.

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